INTERACTION FORCES BETWEEN DENDRONIZED SURFACES

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Dendronized interfaces have recently attracted a lot of attention as a novel class of polymer-modified surfaces. When regularly branched macromolecules are end-tethered to a solid substrate at high grafting density, inter-dendron contacts dominate over intra-molecular ones and a brush of dendrons exhibits novel features compared to a brush of linear macromolecules. A significant part of experimental and theoretical research in the field of polymer brushes now focuses on exploring "topological" dimension in the design parameter space. This direction of research is motivated by a promise to create thinner protective layers to ensure steric repulsion between polymer-decorated particles and, at the same time, offer many terminal segments that can be used for functionalizations.

We present a comprehensive update on the research of brushes formed by branched macromolecules with the emphasis on the effect of chain architecture on the steric repulsion and lubrication properties. Theoretical insights into the structural properties of the dendron-modified surfaces are obtained with the analytical SS-SCF self-consistent field theory based on the strong-stretching (SS) approximation. The analytical predictions are systematically compared to the results of the numerical Scheutjens-Fleer self-consistent filed (SF-SCF) modeling. The theory allows for a unified description of the impact of branching on the stabilizing properties of dendron brushes [1]. We discuss also a cycled architectiure of the tethered polymer [2], and present the results showing that apposing brushes of macrocyles exhibit a relatively low interpenetration length. This is in line with MD simulations [3] which showed a low friction coefficient in the linear regime of lubrication for brushes composed of tethered macrocycles compared to linear chain brushes under similar conditions.

We therefore argue that there is an important role of chain architecture to control colloidal stability and lubrication properties of surfaces with polymer brushes.

References

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